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Monthly Performance Report

LUTZ-SOTIRE

FEBRUARY 1979

U.S. Department of Energy

National Solar Heating and Cooling Demonstration Program

National Solar Data Program

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MONTHLY PERFORMANCE REPORT
LUTZ-SOTIRE
FEBRUARY 1979

I. SYSTEM DESCRIPTION

The Lutz-Sotire solar energy system serves a three-story, 25,000-square foot office building located in Stamford, Connecticut. This retrofit system supplies energy to a distributed heat pump system consisting of 64 water-to-air heat pump units connected in a closed hydronic loop. The solar collector array contains 2,561 square feet of collector area consisting of 138 flat-plate collectors augmented by 2,927 square feet of reflectors. The collectors are tilted at 55 degrees, the reflectors at 10 degrees from the horizontal. A 50 percent ethylene glycol solution is used as the energy collection and transport fluid. Solar energy is stored in water contained in a 6,000-gallon storage tank partially buried beneath the parking lot. From the storage tank, solar heated water is distributed to the building's heat pump loop. The existing electrical hot water boiler provides auxiliary energy.

Because the solar energy system supplies its energy to the heat pump hydronic loop, the terminology normally used in the National Solar Heating and Cooling Demonstration must be modified. Heating load normally applies to energy added to the air of the conditioned space; however, in this system, it will be understood to refer to the energy demand on the equipment supplying energy to the heat pump hydronic loop. This energy is the sum of the solar and auxiliary energy extracted from those subsystem reservoirs and whatever energy may be added to the hydronic loop by individual heat pumps extracting heat from the conditioned space and placing it in the hydronic loop (cooling mode).

The Lutz-Sotire solar energy system, shown schematically in Figure 1, has the following modes of operation:

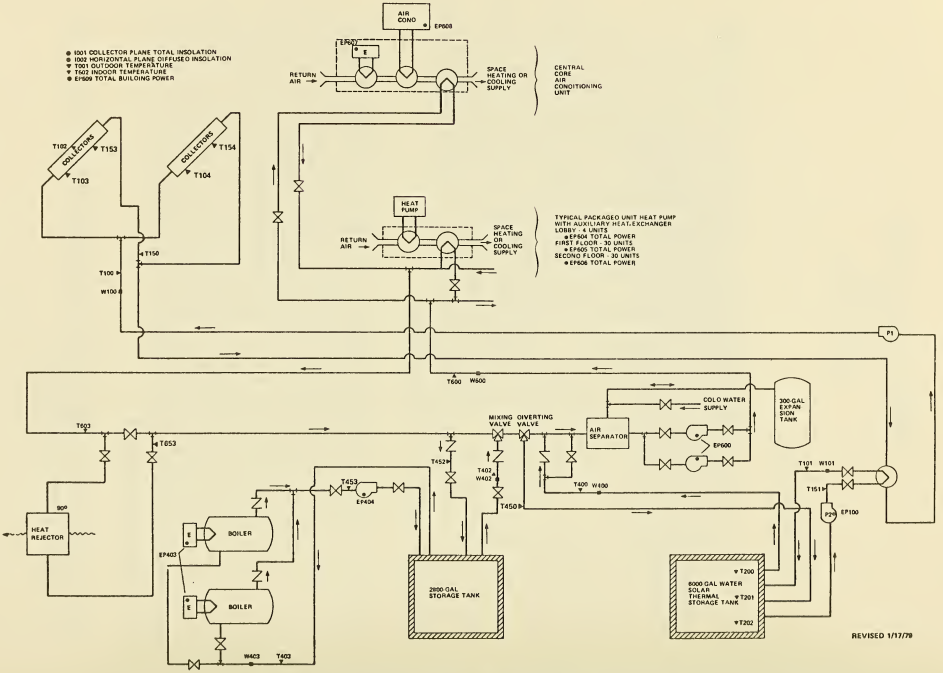

Figure 1. LUTZ-SOTIRE SOLAR ENERGY SYSTEM SCHEMATIC

Mode 1 - Collector-to-Storage: This mode is initiated whenever the collector plate temperature is approximately 20°F above the solar tank temperature. This mode is exited when this temperature differential drops below 5°F.

Mode 2 - Storage-to-Space Heating: This mode is initiated whenever the supply temperature of the closed cycle hydronic loop falls below 80°F and the temperature of the solar storage tank is above 75°F. Solar heated water is fed into the hydronic loop until its temperature rises to 80°F or until the temperature of the solar storage tank falls below 75°F.

Mode 3 - Auxiliary Heating: This mode is activated whenever the supply temperature of the closed cycle hydronic loop falls below 75°F. Water heated by the existing electrical boilers will be fed into the hydronic loop until the supply temperature rises to 75°F.

II. PERFORMANCE EVALUATION

The system performance evaluations discussed in this section are based primarily on the analysis of the data presented in the attached computer-generated monthly report. This attached report consists of daily site thermal and energy values for each subsystem, plus environmental data. The performance factors discussed in this report are based upon the definitions contained in NBSIR 76-1137, Thermal Data Requirements and Performance Evaluation Procedures for the National Solar Heating and Cooling Demonstration Program.

A. Introduction

The Lutz-Sotire solar energy system was operational throughout the month of February. It supplied 28.6 million Btu of energy to the hydronic loop serving the several heat pumps whose total demand was 83.1 million Btu. This represented 42 percent of the total energy supplied to the heat pump array and an estimated 23 percent of the space heating load.

Direct measurement of both the solar and auxiliary energy contributions to the hydronic loop are precluded by instrumentation problems. Estimations of these parameters based upon other measured data have been substituted for the missing measured data which has been nulled from the individual subsystem reports.

B. Weather

The average ambient temperature for the month was 20°F. This is compared with 34°F for a long-term average taken at the Bridgeport, Connecticut, weather station 30 miles to the north. The average insolation in the plane of the collector array was 1,317 Btu/ft^2-day as compared with 1,058 Btu/ft^2-day long-term average. This long-term prediction was obtained from the New York weather station 30 miles to the south.

C. System Thermal Performance

Collector - Of the 94.4 million Btu incident upon the collector array during the month, 35.0 million Btu were collected. This represents a collector array efficiency of 37 percent. Operating energy of 2.8 million Btu (833 kwh) was required to collect and store this energy.

Storage - From the 35.0 million Btu collected, 33.5 million Btu were delivered to storage. Nearly constant daily usage of the energy from this tank kept the average temperature at 84°F. Because of an instrumentation incompatibility, energy removed from storage as normally tabulated on the Storage Performance Report has been nulled and a better estimate is obtained assuming the uncontrolled losses are 10 percent of the input energy and using the equation:

$$STEI = STEO + STECH + STLOSS$$

Solving for STEO

STEO = STEI - STECH - STLOSS
= STEI - STECH - (0.1 X STEI)
= 33.5 - 1.6 - 3.3
= 28.6 million Btu

Space Heating - Space heating at the Lutz-Sotire site is accomplished by 64 individual heat pumps which use as their source a hydronic loop whose temperature is maintained by solar and auxiliary sources. There is no direct contribution to the space heating load by solar energy. A tabulation of the energy removed from the hydronic loop by the heat pumps has been listed under the heading Space Heating Load on the Space Heating Subsystem report. This demand has resulted in a measured 83.1 million Btu being removed from the hydronic loop. A further discussion of this quantity is contained in Section D, Observations.

D. Observations

Using a technique developed in the December (Narrative) report on this site, a comparison figure for the hydronic loop demand as measured may be calculated. It should be noted that the total energy extracted from the hydronic loop should not be greater than the total energy collected plus the auxiliary electrical energy demand, for there are known uncontrolled losses to the environment. The energy removed from storage has already been calculated as 28.6 million Btu. It will be assumed that all of this energy was inserted into the hydronic loop.

Because the temperature of the auxiliary storage tank is known to be maintained at a higher temperature than the solar tank, the losses will be assumed to be 20 percent of the total energy supplied. All of the remaining energy consumed by the electric boiler will be assumed to have been supplied to the hydronic loop. As may be seen on the Space Heating Subsystem report, the total auxiliary energy consumed was 49.4 million Btu. It will be assumed that 80 percent of this energy or 39.5 million Btu was actually inserted into the hydronic loop.

It may be seen that the sum of the solar and auxiliary energy added to the hydronic loop is 68.1 million Btu. This figure is substantially below the measured demand of 83.1 million Btu. No explanation of this occurrence is presently available. An instrumentation subsystem study is continuing to evaluate the entire philosophy of instrumenting sites of this type and this site in particular.

It is believed that the total energy input to the hydronic loop is more nearly approximated by the sum of the auxiliary and solar energy contributions (modified for losses) than is the direct measurement at the load. Under this assumption, the solar fraction of the load can be calculated as

$$SFR = \frac{\text{solar energy}}{\text{solar energy + auxiliary energy + heat pump electrical energy}}$$

$$= \frac{28.6}{28.6 + 39.5 + 55.4} = 23 \text{ percent.}$$

E. Energy Savings

Based on the assumptions and calculation shown above, a total of 25.8 million Btu of electrical energy savings was realized. This value assumes that had there been no solar energy system, all energy supplied to the hydronic loop would have come from the auxiliary source.

III. ACTION STATUS

A thorough reevaluation of the instrumentation subsystem at the site is in progress. Under consideration are:

(1) Increasing the existing voltage to all flowmeters and electrically converting them to totalizing meters, thus reducing threshold sensitivity to 5-7 gpm.

(2) Investigating and recalibrating where necessary all temperature sensors involved in the heat pump hydronic loop energy balance calculations.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: LUTZ-SOTIRE STAMFORD, CT. SOLAR/2027-79/02
REPORT PERIOD: FEBRUARY,1979

SITE/SYSTEM DESCRIPTION:
LUTZ-SOTIRE IS A 3 STORY OFFICE BUILDING WITH 25,000 SQUARE FEET OF HEATED SPACE. THE SOLAR ENERGY SYSTEM IS A RETROFIT TO A DISTRIBUTED HEAT PUMP SYSTEM CONSISTING OF 70 WATER-TO-AIR HEAT PUMP UNITS CONNECTED IN A CLOSED CYCLE HYDRONIC LOOP. THE SOLAR SYSTEM CONSIST OF 138 FLAT PLATE COLLECTORS AUGMENTED BY REFLECTORS. A 50% ETHYLENE GLYCOL SOLUTION CIRCULATES THROUGH THE COLLECTORS TO A LIQUID-TO-LIQUID HEAT EXCHANGER. WATER FROM THE 6,000 GALLON STORAGE TANK CIRCULATES THROUGH THE OTHER SIDE. FROM THE STORAGE TANK, SOLAR HEATED WATER IS ALSO DISTRIBUTED TO THE BUILDING'S HEAT PUMP LOOP.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	94.441	MILLION BTU
	36877	BTU/SQ.FT.
COLLECTED SOLAR ENERGY	34.966	MILLION BTU
	13653	BTU/SQ.FT.
AVERAGE AMBIENT TEMPERATURE	20	DEGREES F
AVERAGE BUILDING TEMPERATURE	74	DEGREES F
ECSS SOLAR CONVERSION EFFICIENCY	@	
ECSS OPERATING ENERGY	2.842	MILLION BTU
TOTAL SYSTEM OPERATING ENERGY	6.498	MILLION BTU
TOTAL ENERGY CONSUMED	90.842	MILLION BTU

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL
LOAD	N.A.	83.087	N.A.	9.283 MILLION BTU
SOLAR FRACTION	N.A.	@	N.A.	@ PERCENT
SOLAR ENERGY USED	N.A.	@	N.A.	@ MILLION BTU
OPERATING ENERGY	N.A.	3.657	N.A.	6.498 MILLION BTU
AUX. THERMAL ENERGY	N.A.	@	N.A.	0.099 MILLION BTU
AUX. ELECTRIC FUEL	N.A.	49.378	N.A.	49.378 MILLION BTU
AUX. FOSSIL FUEL	N.A.	N.A.	N.A.	N.A. MILLION BTU
ELECTRICAL SAVINGS	N.A.	@	N.A.	@ MILLION BTU
FOSSIL SAVINGS	N.A.	N.A.	N.A.	N.A. MILLION BTU

SYSTEM PERFORMANCE FACTOR: C.CSC

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM,FEBRUARY 28,1978, SOLAR/C004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: LUTZ-SOTIRE STAMFORD, CT. SOLAR/2027-79/02
REPORT PERIOD: FEBRUARY,1979

SITE/SYSTEM DESCRIPTION:
LUTZ-SOTIRE IS A 2 STORY OFFICE BUILDING WITH 25,000 SQUARE FEET OF HEATED SPACE. THE SOLAR ENERGY SYSTEM IS A RETROFIT TO A DISTRIBUTED HEAT PUMP SYSTEM CONSISTING OF 70 WATER-TO-AIR HEAT PUMP UNITS CONNECTED IN A CLOSED CYCLE HYDRONIC LOOP. THE SOLAR SYSTEM CONSIST OF 138 FLAT PLATE COLLECTORS AUGMENTED BY REFLECTORS. A 50% ETHYLENE GLYCOL SOLUTION CIRCULATES THROUGH THE COLLECTORS TO A LIQUID-TO-LIQUID HEAT EXCHANGER. WATER FROM THE 6,000 GALLON STORAGE TANK CIRCULATES THROUGH THE OTHER SIDE. FROM THE STORAGE TANK, SOLAR HEATED WATER IS ALSO DISTRIBUTED TO THE BUILDING'S HEAT PUMP LOOP.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	99.635	GIGA JOULES
	418770	KJ/SQ.M.
COLLECTED SOLAR ENERGY	36.889	GIGA JOULES
	155047	KJ/SQ.M.
AVERAGE AMBIENT TEMPERATURE	-7	DEGREES C
AVERAGE BUILDING TEMPERATURE	23	DEGREES C
ECSS SOLAR CONVERSION EFFICIENCY	N.A.	
ECSS OPERATING ENERGY	2.998	GIGA JOULES
TOTAL SYSTEM OPERATING ENERGY	6.856	GIGA JOULES
TOTAL ENERGY CONSUMED	95.839	GIGA JOULES

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL
LOAD	N.A.	87.657	N.A.	9.793 GIGA JOULES
SOLAR FRACTION	N.A.	@	N.A.	@ PERCENT
SOLAR ENERGY USED	N.A.	@	N.A.	@ GIGA JOULES
OPERATING ENERGY	N.A.	3.858	N.A.	6.856 GIGA JOULES
AUX. THERMAL ENG	N.A.	@	N.A.	0.105 GIGA JOULES
AUX. ELECTRIC FUEL	N.A.	52.094	N.A.	52.094 GIGA JOULES
AUX. FOSSIL FUEL	N.A.	N.A.	N.A.	N.A. GIGA JOULES
ELECTRICAL SAVINGS	N.A.	@	N.A.	@ GIGA JOULES
FOSSIL SAVINGS	N.A.	N.A.	N.A.	N.A. GIGA JOULES

SYSTEM PERFORMANCE FACTOR: C.C5C

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM,FEBRUARY 28,1978, SOLAR/CCC4-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENERGY COLLECTION AND STORAGE SUBSYSTEM (ECSS)

SITE: LUTZ-SOTIRE STAMFORD, CT.
REPORT PERIOD: FEBRUARY, 1979

SOLAR/2027-79/02

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	AMBIENT TEMP DEG-F	ENERGY TO LOADS MILLION BTU	AUX THERMAL TO ECSS MILLION BTU	ECSS OPERATING ENERGY MILLION BTU	ECSS ENERGY REJECTED MILLION BTU	ECSS SOLAR CONVERSION EFFICIENCY
1	4.571	22	0.767	N	0.141	N	@
2	5.149	22	0.246	O	0.160	O	@
3	5.047	25	0.437	T	0.170	T	@
4	3.559	27	0.476		0.115		@
5	3.807	18	0.253	A	0.124	A	@
6	5.324	17	0.474	P	0.162	P	@
7	0.265	17	0.000	P	0.000	P	@
8	5.486	23	0.248	L	0.151	L	@
9	5.340	14	0.557	I	0.164	I	@
10	4.554	7	0.750	C	0.132	C	@
11	5.864	3	0.506	A	0.172	A	@
12	1.899	7	0.304	B	0.085	B	@
13	3.220	7	0.375	L	0.078	L	@
14	3.044	6	0.708	E	0.095	E	@
15	4.655	15	0.248		0.157		@
16	1.959	13	0.402		0.057		@
17	6.006	4	0.587		0.170		@
18	1.677	7	0.000		0.051		@
19	0.477	17	0.000		0.000		@
20	5.736	23	0.594		0.164		@
21	0.490	30	0.570		0.013		@
22	4.615	35	0.620		0.161		@
23	1.226	34	0.406		0.024		@
24	0.343	41	0.133		0.000		@
25	0.309	40	0.000		0.000		@
26	*	*	*		*		@
27	0.715	32	0.000		0.018		@
28	5.733	37	0.053		0.173		@
SUM	94.441	-	9.183	N.A.	2.842	N.A.	-
AVG	3.373	20	0.328	N.A.	0.101	N.A.	@
NBS ID	Q001	N113			Q102		N111

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
COLLECTOR ARRAY PERFORMANCE

SITE: LUIZ-SCIRE STAMFORD, CT. SOLAR/2027-79/02
REPORT PERIOD: FEBRUARY,1979

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	OPERATIONAL INCIDENT ENERGY MILLION BTU	COLLECTED SOLAR ENERGY MILLION BTU	DAYTIME AMBIENT TEMP DEG F	COLLECTOR ARRAY EFFICIENCY
1	4.571	4.358	1.938	24	0.424
2	5.145	4.863	2.304	27	0.447
3	5.047	4.737	2.062	33	0.409
4	3.555	3.148	1.657	33	0.466
5	3.807	3.282	1.431	22	0.376
6	5.324	4.910	2.414	22	0.453
7	0.265	0.000	0.000	19	0.000
8	5.466	4.501	1.841	30	0.336
9	5.340	5.079	1.898	19	0.355
10	4.554	4.192	1.795	14	0.394
11	5.664	5.483	2.219	10	0.395
12	1.899	1.310	0.268	15	0.141
13	3.220	1.712	0.435	*	0.135
14	3.044	2.314	0.795	10	0.261
15	4.655	4.235	1.702	20	0.366
16	1.966	1.427	0.467	14	0.239
17	6.006	5.544	2.249	8	0.374
18	1.677	0.732	0.135	13	0.080
19	0.477	0.000	0.000	21	0.000
20	5.736	5.327	2.300	35	0.401
21	0.490	0.108	0.000	34	0.000
22	4.615	4.362	2.256	47	0.510
23	1.226	0.407	0.200	37	0.163
24	0.343	0.000	0.000	44	0.000
25	0.309	0.000	0.000	43	0.000
26	*	*	*	*	*
27	0.715	0.188	0.039	36	0.054
28	5.733	5.197	3.113	49	0.543
SUM	94.441	80.698	34.966	-	-
AVG	3.373	2.882	1.249	26	0.370
NBSID	Q001		C100		N100

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
STORAGE PERFORMANCE

SITE: LUTZ-SOTIRE STAMFORD, CT. SOLAR/2027-79/02
REPORT PERIOD: FEBRUARY,1979

DAY OF MONTH	ENERGY TO STORAGE MILLION BTU	ENERGY FROM STORAGE MILLION BTU	CHANGE IN STORED ENERGY MILLION BTU	STORAGE AVERAGE TEMP DEG F	STORAGE EFFICIENCY
1	2.002	@	-1.546	91	@
2	2.162	@	C.667	90	@
3	2.158	@	C.238	93	@
4	1.226	@	-C.857	88	@
5	1.512	@	C.C38	81	@
6	2.282	@	-C.C48	87	@
7	C.0C0	@	-C.C38	76	@
8	1.876	@	C.260	87	@
9	2.095	@	-C.175	85	@
10	1.652	@	C.C03	80	@
11	2.079	@	-C.C25	82	@
12	C.274	@	-C.C06	76	@
13	C.4C9	@	C.C38	77	@
14	C.7C6	@	C.CC0	78	@
15	1.545	@	-C.C13	83	@
16	C.431	@	C.C16	77	@
17	2.119	@	-C.C16	82	@
18	C.C93	@	C.C89	78	@
19	C.CC0	@	-C.102	77	@
20	2.124	@	1.666	97	@
21	C.024	@	-1.726	84	@
22	2.19C	@	2.250	99	@
23	C.148	@	-2.C47	95	@
24	C.CC0	@	-C.21C	76	@
25	C.CC0	@	-C.C16	75	@
26	*	@	*	*	@
27	C.005	@	C.C10	74	@
28	2.841	@	3.131	106	@
SUM	33.451	@	1.577	-	-
AVG	1.195	@	C.C56	84	@
NBS IC	Q200	Q201	Q202		N108

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SPACE HEATING SUBSYSTEM

SITE: LUTZ-SOTIRE STAMFORD, CT. SOLAR/2027-79/02
REPORT PERIOD: FEBRUARY,1979

DAY OF MON.	SPACE HEATING LOAD MILLION BTU	SOLAR FR.OF LOAD PCT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	BLDG TEMP DEG. F	AMB TEMP DEG. F
1	2.640	@	@	C.113	@	C.754	NOT	@	NOT	76	22
2	2.544	@	@	C.121	@	C.858		@		75	22
3	2.040	@	@	C.116	@	1.077		@		74	25
4	2.382	@	@	C.116	@	1.044		@		75	27
5	3.186	@	@	C.139	@	1.500	APPLICABLE	@	APPLICABLE	74	18
6	3.888	@	@	C.138	@	1.585		@		74	17
7	3.089	@	@	C.154	@	2.611		@		73	17
8	2.284	@	@	C.120	@	C.835		@		73	23
9	2.916	@	@	C.126	@	1.219		@		73	14
10	4.147	@	@	C.151	@	1.951		@		74	7
11	4.975	@	@	C.155	@	2.270		@		73	3
12	4.471	@	@	C.153	@	3.310		@		74	7
13	4.814	@	@	C.160	@	3.642		@		74	7
14	4.942	@	@	C.164	@	3.292		@		75	6
15	3.495	@	@	C.147	@	2.222		@		74	15
16	2.776	@	@	C.161	@	2.656		@		74	12
17	4.706	@	@	C.153	@	2.489		@		75	4
18	5.286	@	@	C.165	@	4.076		@		75	7
19	4.851	@	@	C.164	@	3.499		@		74	17
20	2.438	@	@	C.103	@	1.765		@		75	23
21	1.828	@	@	C.117	@	C.987		@		74	30
22	0.692	@	@	C.080	@	C.512		@		76	39
23	1.104	@	@	C.077	@	C.264		@		74	34
24	0.610	@	@	C.111	@	C.640		@		73	41
25	1.172	@	@	C.116	@	1.029		@		72	40
26	*	@	@	*	@	*		@		*	*
27	1.106	@	@	C.132	@	1.095		@		76	33
28	0.737	@	@	C.074	@	C.551		@		77	37
SUM	83.087	-	@	3.657	@	49.378	N.A.	@	N.A.	-	-
AVG	2.967	@	@	C.131	@	1.763	N.A.	@	N.A.	74	20
NBS	Q402	N400	Q400	Q403	Q401		Q410	Q415	Q417	N406	N113

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENVIRONMENTAL SUMMARY

SITE: LUTZ-SOTIRE STAMFORD, CT.
REPORT PERIOD: FEBRUARY,1979

SOLAR/2027-79/02

DAY OF MONTH	TOTAL INSOLATION BTU/SQ.FT	DIFFUSE INSOLATION BTU/SQ.FT	AMBIENT TEMPERATURE DEG F	DAYTIME AMBIENT TEMP DEG F	RELATIVE HUMIDITY PERCENT	WIND DIRECTION DEGREES	WIND SPEED M.P.H.
1	1785	880	22	24	N	N	N
2	2011	747	22	27	O	O	O
3	1971	688	25	33	T	T	T
4	1390	338	27	33			
5	1486	374	18	22	A	A	A
6	2079	550	17	22	P	P	P
7	103	72	17	19	P	P	P
8	2142	711	23	30	L	L	L
9	2085	646	14	19	I	I	I
10	1778	514	7	14	C	C	C
11	2290	547	3	10	A	A	A
12	741	432	7	15	B	B	B
13	1257	752	7	*	L	L	L
14	1188	547	6	10	E	E	E
15	1817	595	15	20			
16	765	292	13	14			
17	2345	530	4	8			
18	655	530	7	13			
19	186	113	17	21			
20	2240	1122	23	35			
21	191	145	30	34			
22	1802	536	39	47			
23	479	334	34	37			
24	134	97	41	44			
25	121	85	40	43			
26	*	*	*	*			
27	279	191	33	36			
28	2235	1377	37	45			
SUM	36877	15082	-	-	-	-	-
AVG	1317	539	20	26	N.A.	N.A.	N.A.
NBS ID	Q001		N113			N115	N114

* DENOTES UNAVAILABLE DATA.
a DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

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